Remarks

Reconsideration of the application is requested in view of the foregoing amendments and the following remarks. Claims 1-42 and 66-70 are presently pending in the application. Claims 1, 6, 9, 14-15, 19, 30-31, 34, and 69-70 are amended, and claims 16-18 are canceled without prejudice. Upon entry of this Amendment, claims 1-15, 19-42, and 66-70 are in the application.

Support for the amendments to the claims can be found in the specification at, for example page 7, lines 3-8; and Figs. 2-3. Claims 69 and 70 are amended to correct obvious typographical errors. No new matter is added.

Rejections under 35 U.S.C. § 102(e) in View of Yamauchi

Claims 1-9, 12-31, 34 and 36 stand rejected under 35 USC § 102(e) as allegedly anticipated by U.S. Pat. No. 6,284,587 to Yamauchi et al. ("Yamauchi"). This rejection is respectfully traversed.

Amended independent claim 1 recites a "providing a layer containing ruthenium oxide; converting at least a portion of the ruthenium oxide in the layer to ruthenium so as to produce a ruthenium-containing layer having a rough surface; and annealing the rough-surfaced ruthenium layer in an oxidizing ambient to form passivated ruthenium in an outer portion of the rough-surfaced ruthenium layer." Yamauchi does not teach or suggest such a method. Yamauchi teaches forming a TiO_2 layer from TiN using a RuO_2 layer to supply oxygen to the TiN layer in order to avoid exposure of other layers to oxidizing ambients. See, for example, col. 4, lines 25-30. Because Yamauchi does not teach or suggest annealing a ruthenium-containing layer in an oxidizing ambient, claim 1 and dependent claims 2-5 are properly allowable over Yamauchi.

Amended independent claim 6 recites a method of forming an enhanced-surface-area electrically conductive structure. The method comprises providing a layer containing ruthenium oxide; converting at least a portion of the ruthenium oxide to ruthenium by heating the layer in a reduced-pressure environment with a pressure of about 75 torr or less so as to produce a layer having a rough surface; and annealing the portion of ruthenium oxide that is converted to ruthenium in an oxidizing ambient to form a passivated ruthenium portion. Yamauchi does not teach or suggest such a method and instead teaches that exposure to an oxidizing ambient is to be avoided. Accordingly, claim 6 and dependent claims 7-13 are properly allowable.

Amended independent claim 14 recites, in part, annealing a rough-surfaced ruthenium-containing layer in an oxidizing ambient to form a passivated ruthenium portion. As noted above, Yamauchi teaches methods of avoiding the use of oxidizing ambients by supplying oxygen from RuO_2. Yamauchi does not teach or suggest the combination of features recited in claim 14, and claim 14 is properly allowable.

Amended independent claim 15 recites a method of forming an enhanced-surface-area electrically conductive structure. The method includes, in part, exposing a ruthenium containing layer having a rough surface to an oxidizing ambient. As noted above, Yamauchi teaches methods of avoiding the use of oxidizing ambients by supplying oxygen from RuO_2. For at least this reason, claim 15 and dependent claim 19 are properly allowable.

Claim 20 recites a method of forming an enhanced-surface-area electrically conductive structure. The method comprises, in part, converting some ruthenium oxide in a layer to ruthenium by heating the layer in a reduced-pressure environment in a non-oxidizing ambient so as to produce a ruthenium-containing layer having a rough surface with a mean feature size of at least about 100 Angstroms. Yamauchi does not teach or suggest a layer having a rough surface, and claim 20 and dependent claims 21-29 are properly allowable over Yamauchi.

Amended independent claim 30 recites a method of forming an enhanced-surface-area electrically conductive layer. The method comprises providing a layer containing ruthenium oxide, selecting anneal conditions adapted to convert at least a portion of the ruthenium oxide to ruthenium, annealing the layer under said conditions so as to produce a layer having a rough surface; and passivating the annealed layer by exposing the annealed layer to an oxidizing ambient. As noted above, Yamauchi does not teach or suggest passivating a ruthenium containing layer by exposure to an oxidizing ambient. Therefore, claim 30 is properly allowable.

Amended independent claim 31 recites a method of forming a ruthenium-containing enhanced-surface-area electrically conductive layer. The method comprises depositing a continuous layer consisting essentially of ruthenium oxide onto a supporting structure, and annealing the layer in reduced pressure environment in a non-oxidizing ambient so as to substantially convert the ruthenium oxide to ruthenium, leaving a discontinuous roughened layer consisting essentially of ruthenium on the supporting structure. Yamauchi does not teach or suggest such depositing a continuous layer and annealing so as to produce a discontinuous layer. Accordingly, claim 31 is properly allowable.

Claim 34 recites a method of forming a capacitor, comprising providing a continuous layer containing ruthenium oxide, converting least some of the ruthenium oxide to ruthenium so as to produce a resulting discontinuous layer having a rough surface, forming a layer of dielectric material over the resulting layer, and forming a layer of conductive material over the layer of dielectric material. Yamauchi does not teach or suggest forming a discontinuous layer in this way, and therefore, claim 34 and dependent claims 35-36 are properly allowable over Yamauchi.

Rejections under 35 USC § 102(e) in View of Tanaka

Claims 32-35, 37, 38, 40-42 and 66-69 stand rejected under 35 USC § 102(e) as allegedly anticipated by U.S. Pat. No. 6,355,492 to Tanaka et al. ("Tanaka"). This rejection is respectfully traversed.

Independent claims 32 and 33 recite, in part, a "method of forming an enhanced-surface-area electrically conductive layer, the method comprising . . . annealing the layer comprising ruthenium oxide to ruthenium [producing a] layer having a textured surface with a mean feature size of about 100 Angstroms or more." Tanaka does not teach or suggest such a method. Tanaka is silent as to a textured surface with a mean feature size of about 100 Angstroms or more. The Action points to Tanaka, col.6, lines 20-34 as teaching this method, but this passage actually describes how ruthenium oxide in *powder* form (not layer form) is transformed into ruthenium metal single-crystal powder form. Thus, this passage does not teach a textured surface with a mean feature size of about 100 Angstroms or more. Instead, Tanaka teaches that "the capacitor is free from the impairment of flatness of the electrode surface." See col. 5, lines 36-38. For at least these reasons, Tanaka does not teach or suggest the methods of independent claims 32 and 33. The rejection should be withdrawn, and such action is respectfully requested.

Independent claim 34 recites, in part, a "method of forming a capacitor, the method comprising: providing a layer containing ruthenium oxide; converting at least some of the ruthenium oxide to ruthenium so as to produce a resulting layer having a rough surface." Tanaka does not teach or suggest such a method. Instead, Tanaka teaches that "a lower electrode layer 22A . . . of Ru is formed . . . by sputtering. . . . The lower electrode layer 22A corresponding to a metal layer [Ru] is heat-treated . . . whereby a metal oxide layer 22B (RuO_2) is formed." See col. 9, lines 5-7 and 35-40. Thus, Tanaka teaches forming a ruthenium oxide layer from a ruthenium layer, not the other way around. The cited portion of Tanaka (col. 6, lines 20-34) teaches creating Ru metal single-crystal powder (not a layer) from Ru oxide powder. Additionally,

Tanaka is silent as to a "layer having a rough surface." Instead, Tanaka teaches that "the capacitor is free from the impairment of flatness of the electrode surface." See col. 5, lines 36-38. For at least these reasons, independent claim 34 and dependent claims 35, 37, 38 and 40 are allowable over Tanaka. The rejection should be withdrawn, and such action is respectfully requested.

Independent claim 41 recites, in part, a "method comprising: providing a first layer of electrically conductive material; forming a layer containing ruthenium oxide on the layer of electrically conductive material; annealing the layer containing ruthenium oxide so as to convert at least some of the ruthenium oxide to ruthenium and so as to produce a rough resulting surface with a mean grain size of at least about 100 Angstroms." Tanaka does not teach or suggest such a method. For example, as explained above with respect to claims 32 and 33, Tanaka does not teach or suggest producing a rough surface with mean grain size of at least about 100 Angstroms. Also, as explained above with respect to claim 34, Tanaka does not teach forming a layer of ruthenium from a layer of ruthenium oxide but instead teaches forming a layer of ruthenium oxide from a ruthenium layer. For at least these reasons, independent claim 41 and dependent claim 42 are allowable over Tanaka. The rejection should be withdrawn, and such action is respectfully requested.

Independent claim 66 recites, in part, a "method comprising: providing a layer containing ruthenium oxide; converting at least some of the ruthenium oxide to ruthenium so as to produce a resulting layer having a rough surface." Tanaka does not teach or suggest such a method. For example, as explained above with respect to claim 34, Tanaka does not teach or suggest producing a layer having a rough surface. Also, as explained above with respect to claim 34, Tanaka does not teach forming a layer of ruthenium from a layer of ruthenium oxide. For at least these reasons, independent claim 66 and dependent claims 67-69 are allowable over Tanaka. The rejection should be withdrawn, and such action is respectfully requested.

Rejections under 35 USC § 102(e) in view of Phillips

Claims 20, 24 and 25 stand rejected under 35 USC § 102(e) as allegedly anticipated by U.S. Pat. No. 6,458,183 to Phillips et al. ("Phillips"). This rejection is respectfully traversed.

Independent claim 20 recites, in part, a "method comprising . . . converting some ruthenium oxide in the layer to ruthenium by heating the layer in a reduced-pressure environment." Phillips does not teach or suggest such a method. For example, Phillips does not

teach heating a layer in a reduced-pressure environment. Instead, Phillips teaches processing ruthenium layers at "relatively high pressures (near ambient pressure and temperature). . . ." For at least this reason, independent claim 20 and dependent claims 24 and 25 are allowable over Phillips. The rejection should be withdrawn, and such action is respectfully requested.

Rejections under 35 USC § 103 in View of Yamauchi and Tanaka

Claims 10 and 11 stand rejected under 35 USC § 103(a) as allegedly obvious from a combination of Yamauchi and Tanaka. This rejection is respectfully traversed. Claims 10 and 11 depend from allowable claim 6 and are allowable for at least this reason.

Rejections under 35 USC § 103(a) in View of Tanaka and Kiyotoshi

Claims 39 and 70 stand rejected under 35 USC § 103(a) as allegedly obvious over Tanaka in view of U.S. Pat. No. 6,091,099 to Kiyotoshi et al. ("Kiyotoshi"). This rejection is respectfully traversed. Claims 39 and 70 depend from claims 37 and 66, respectively, and are properly allowable for at least this reason.

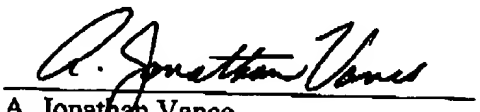
Conclusion

In view of the foregoing amendments and remarks, all pending claims are in condition for allowance. Such action is respectfully requested.

If any questions regarding this application remain, the Examiner is requested to call the undersigned attorney.

Respectfully submitted,

KLARQUIST SPARKMAN, LLP

By 

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